

In re Patent Application of:

GRANT

Serial No. 10/781,977

Filing Date: FEBRUARY 19, 2004

REMARKS

The Examiner is thanked for the thorough examination of the present application. Based upon the amendments and the arguments presented below, it is submitted that all of the claims are patentable.

Independent Claim 17 has been amended to delete reference to the dual function as helpfully suggested by the Examiner.

Independent Claim 29 has been amended to incorporate the subject matter of dependent Claim 32, namely that the silicide formation prevention coating comprises a layer of silicide nitride and a layer of silicide dioxide adjacent. Dependent Claim 32 has been cancelled for consistency. Independent Claim 29 has also been amended to recite forming silicide on the surface of the pixel subsequent to forming the silicide formation prevention coating. Support for this amendment may be found in FIG. 3(c) and on page 8, lines 3-19 of the originally filed specification.

New independent Claim 38 includes the recitations of independent Claim 17 along with the incorporation of the subject matter from dependent Claim 32. However, new independent Claim 38 is directed to a partially formed semiconductor image sensor, and recites that the entire surface of each pixel of the partially formed image sensor is free of silicide. New dependent Claims 40-41 include recitations similar to Claims 18-

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19. New dependent Claims 42-45 include recitations similar to Claims 21-24. No new matter is being added.

I. The Claimed Invention

Amended independent Claim 17, for example is directed to a semiconductor image sensor comprising a pixel including a photosensing portion and a silicide formation prevention coating thereon. The coating has a thickness to operate as an anti-reflective surface at a desired wavelength range.

Amended independent Claim 29 is directed to a method for making a semiconductor image sensor. The method includes forming at least one pixel having a photosensing portion. The method further includes forming a silicide formation prevention coating on the photosensing portion, the silicide formation prevention coating comprising a layer of silicon dioxide and a layer of silicon nitride adjacent thereto. The silicon dioxide and silicon nitride layers have thicknesses chosen such that the silicide formation prevention coating has a thickness for operating as an anti-reflective surface at a desired wavelength. The method further includes forming, subsequent to formation of the silicide formation prevention coating, silicide on the surface of the pixel. The silicide formation prevention coating acts to prevent silicide formation on the photosensing portion.

Independent Claim 38 is directed to a partially formed semiconductor image sensor. The partially formed semiconductor image sensor includes at least one pixel including a

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photosensing portion and a silicide formation prevention coating thereon. The silicide formation prevention coating includes a layer of silicon dioxide and a layer of silicon nitride adjacent thereto. The silicon dioxide and silicon nitride layers have thicknesses chosen such that the silicide formation prevention coating has a thickness for operating as an anti-reflective surface at a desired wavelength range. The entire surface of each pixel of the partially formed image sensor is free of silicide.

II. The Claims Are Patentable

The Examiner rejected independent Claims 17 and 29 as unpatentable over the Chen et al. patent in view of the Rhodes publication. The Chen et al. patent is directed to a CMOS image sensory device with isolated photodiode sensory and transistor device regions. The Examiner correctly notes that Chen et al. fails to disclose a silicide formation prevention coating having a thickness to operate as an anti-reflective surface at a desired wavelength range. The Examiner contends that the Rhodes publication provides this noted deficiency.

A. Claims 17-28 Are Patentable

The Rhodes publication is directed to a photogate based photosensor for use in a CMOS imager. The Examiner contends the thin layer 102 of Rhodes is a silicide formation prevention coating. However, the thin layer 102 is formed to

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cover a gate oxide layer 100 thermally grown over a photosite 52 (See Paragraph 57). The thin layer 102 is not a silicide formation prevention coating, as it is not used during the manufacture of the image sensor to prevent the formation of silicide.

The Examiner further contends that it would have been obvious to modify the Chen et al. semiconductor image sensor structure with a silicide formation prevention coating thickness for operation as an anti-reflective coating, as in Rhodes. Applicants re-emphasize that the Rhodes publication fails to disclose a silicide formation prevention coating, as recited in amended independent Claim 17, and thus the suggested modification of Chen et al. is not possible. Moreover, Applicants submit that although the Rhodes publication discloses a thin layer for permitting the transmission of short wavelength light, this thin layer fails to provide sufficient teaching to modify the Chen et al. patent with a silicide prevention coating having a thickness to operate as an anti-reflective surface at a desired wavelength range, as recited in amended independent Claim 17.

Accordingly, amended independent Claim 17 is patentable. Its dependent claims, which recite further distinguishing features, are also patentable over the prior art and require no further discussion herein.

B. Claims 29-31, 33-45 are Patentable

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The Rhodes publication is discussed above, in addition to its proposed combination with the Chen et al. patent.

The Examiner contends the Chen et al. patent discloses a silicon formation prevention coating including a silicon oxide layer (self-aligned block) 224 and silicon nitride layer (protective layer) 228 as an anti-reflective surface. However, the self-aligned block 224 is positioned in a photodiode sensory region 240 (See FIG. 2E, Col. 4, lines 42-44), while the silicide layer 226 is formed in the transistor device region 250 (See FIG. 2E, Col. 4, lines 49-51). Moreover, the nitride layer 228 is over the silicide regions of the gate, source, and drain. Thus, Chen et al. fails to disclose the step of forming a silicide formation prevention coating including a layer of silicon dioxide and a layer of silicon nitride adjacent thereto, as recited in amended independent Claim 29. New independent Claim 38 similarly recites the silicide formation prevention coating includes a layer of silicon dioxide and a layer of silicon nitride adjacent thereto. In addition, independent claim 38, directed to a partially formed sensor also recites the entire surface of each pixel is free of silicide.

Accordingly, amended independent Claims 29 and new independent Claim 38 are patentable. Their respective dependent claims, which recite further distinguishing features, are also patentable over the prior art and require no further discussion herein.

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CONCLUSIONS

In view of the amendments to the claims and the arguments presented above, it is submitted that all of the claims are patentable. Accordingly, a Notice of Allowance is respectfully requested in due course. Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned at the telephone number listed below.

Respectfully submitted,



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CERTIFICATE OF FACSIMILE TRANSMISSION

I HEREBY CERTIFY that the foregoing correspondence has been forwarded via facsimile number 571-273-8300 to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 this 3rd day of May, 2006.

